

What is Claimed Is:

1. A premixing burner for operating a combustion chamber by means of a liquid and/or gaseous fuel, comprising:

a swirl generator for a combustion inflow air stream for forming a swirl flow;

means for the injection of fuel into the swirl flow, the swirl generator being configured to be adjacent to the combustion chamber indirectly via a mixing zone or directly, in each case via a burner outlet;

a cross-sectional widening at the burner outlet which is discontinuous in the flow direction of the swirl flow and through which the swirl flow bursts open so as to form a backflow zone, the swirl generator having at least two part-conical shells which complete one another to form a body and which jointly enclose a conically designed swirl space with a cone angle 2γ and air inlet slits tangential in the cone longitudinal extent;

a mid-axis (M11, M12) assigned in each case to each part-conical shell, said mid-axes running separately from one another in spatial terms; and

a contour locally narrowing a flow cross section of the swirl generator or of the mixing zone in the flow direction upstream of the burner outlet, which contour is arranged in a region of a foremost front of the backflow zone in the flow direction and has, in the flow direction, a first segment which continuously reduces the flow cross section, a second segment with a smallest flow cross section and a third segment adjoining the second segment in the flow direction and continuously increasing the flow cross section.

2. The premixing burner as claimed in claim 1, wherein the contour provided at the inner circumferential edge of the swirl generator or of the mixing zone.

3. The premixing burner as claimed in claim 1, wherein the contour encloses a flow duct which is designed in the manner of a Venturi tube.

4. The premixing burner as claimed in claim 1, wherein the third segment possesses, within the premixing burner, an axial position which lies in the region of that front of the forming backflow zone which is foremost in the flow direction.

5. The premixing burner as claimed in claim 1, wherein the swirl generator is configured to be directly adjacent to the combustion chamber via the burner outlet, and the contour locally narrowing the flow cross section of the swirl generator is described by geometric conditions as follows:

$$0.5 \leq R1(x)RB(x) \leq 1$$

$$0.5 \leq R2(x)RB(x) \leq 2 \text{ and}$$

$$\gamma < \alpha < 40^\circ$$

with

x: locus coordinate along a mid-axis of a part-conical shell

R1: radial distance between a mid-axis of a part-conical shell and a surface of the contour at a locus x along the mid-axis

RB: radial distance between the mid-axis of a part-conical shell and the surface of the original part-conical shell at the locus x along the mid-axis

R2: elevation of the contour, measured from the surface of the part-conical shell at the locus x along the mid-axis

α : angle between a tangential surface of the contour and the mid-axis of the part-conical shell at the locus x along the mid-axis

γ : cone half angle.

6. The premixing burner as claimed in claim 1, wherein the premixing burner is a double cone burner, and the smallest flow cross section is shaped elliptically in the region of the contour.

7. The premixing burner as claimed in claim 1, wherein the combustion chamber is followed by turbine stages of a gas turbine plant.

8. A method for operating a combustion chamber, comprising:
operating a combustion chamber having a premixing chamber using a liquid and/or gaseous fuel;

forming a swirl flow with a swirl generator for a combustion inflow air stream;

injecting fuel into the swirl flow, the swirl generator being configured to be adjacent to the combustion chamber indirectly via a mixing zone or directly, in each case via a burner outlet;

forming a backflow zone using a cross-sectional widening at the burner outlet which is discontinuous in the flow direction of the swirl flow and through which the swirl flow bursts open, the swirl generator having at least two part-conical shells which complete one another to form a body and which jointly enclose a conically designed swirl space with a cone angle 2γ and air inlet slits tangential in the cone longitudinal extent, a mid-axis (M11, M12) being assigned in each case to each part-conical shell, said mid-axes running separately from one another in spatial terms; and a contour locally narrowing a flow cross section of the swirl generator or of the mixing zone in the flow direction upstream of the burner outlet, which contour is arranged in a region of a foremost front of the backflow zone in the flow direction and has, in the flow direction, a first segment which continuously reduces the flow cross section, a second segment with a smallest flow cross section and a third segment adjoining the second segment in the flow direction and continuously increasing the flow cross section; and

locally accelerating and decelerating the swirl flow in the axial flow direction within the swirl generator or in a mixing zone adjoining the swirl generator.

9. The method as claimed in claim 8, wherein the axial acceleration of the swirl flow takes place upstream of the foremost front of the forming backflow zone, and deceleration takes place at least partially upstream of the foremost front of the forming backflow zone.

10. The method as claimed in claim 8, wherein the acceleration and deceleration take place, utilizing the Bernoulli effect.

11. The method as claimed in claim 8, wherein the swirl gradient of the swirl flow is increased locally in the flow direction.

12. The premixing burner as claimed in claim 2, wherein the contour encloses a flow duct which is designed in the manner of a Venturi tube.

13. The premixing burner as claimed in claim 12, wherein the third segment possesses, within the premixing burner, an axial position which lies in the region of that front of the forming backflow zone which is foremost in the flow direction.

14. The premixing burner as claimed in claim 13, wherein the swirl generator is configured to be directly adjacent to the combustion chamber via the burner outlet, and the contour locally narrowing the flow cross section of the swirl generator is described by geometric conditions as follows:

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$$0.5 \leq R1(x)RB(x) \leq 1$$

$$0.5 \leq R2(x)RB(x) \leq 2 \text{ and}$$

$$\gamma < \alpha < 40^\circ$$

with

- x: locus coordinate along a mid-axis of a part-conical shell
- R1: radial distance between a mid-axis of a part-conical shell and a surface of the contour at a locus x along the mid-axis
- RB: radial distance between the mid-axis of a part-conical shell and the surface of the original part-conical shell at the locus x along the mid-axis
- R2: elevation of the contour, measured from the surface of the part-conical shell at the locus x along the mid-axis
- α : angle between a tangential surface of the contour and the mid-axis of the part-conical shell at the locus x along the mid-axis
- γ : cone half angle.

15. The premixing burner as claimed in claim 14, wherein the premixing burner is a double cone burner, and the smallest flow cross section is shaped elliptically in the region of the contour.

16. The premixing burner as claimed in claim 15, wherein the combustion chamber is followed by turbine stages of a gas turbine plant.

17. The method as claimed in claim 9, wherein the acceleration and deceleration take place, utilizing the Bernoulli effect.